# Climate Change: Consequences for Alaska

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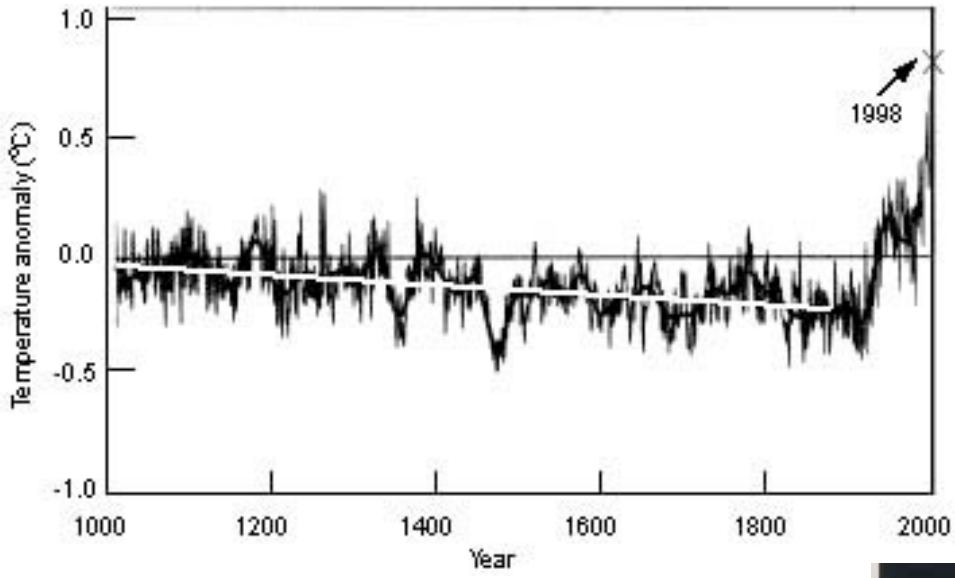
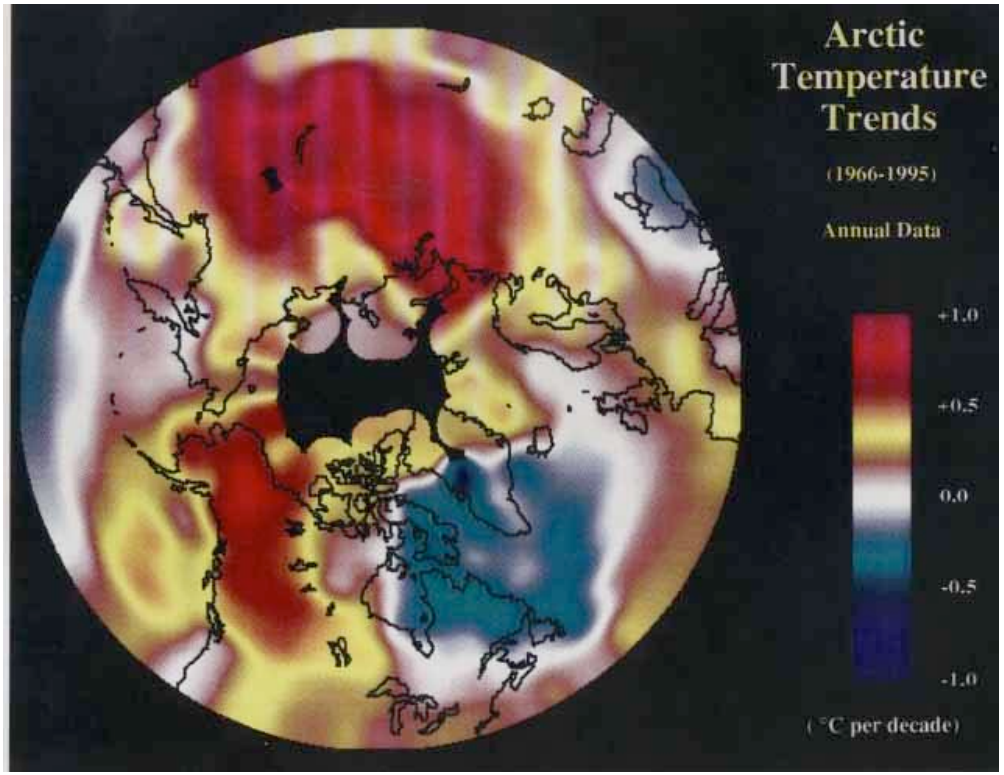
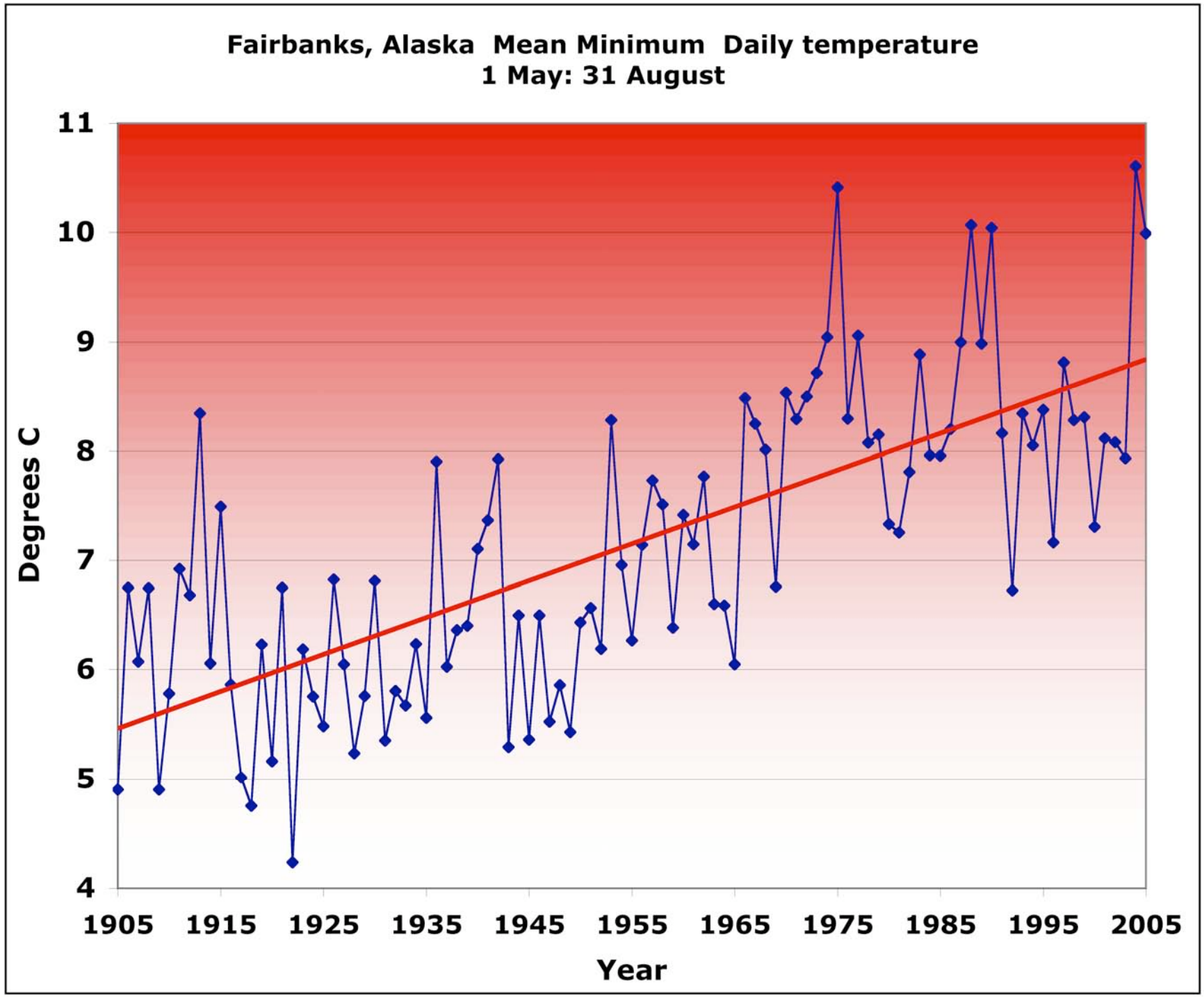


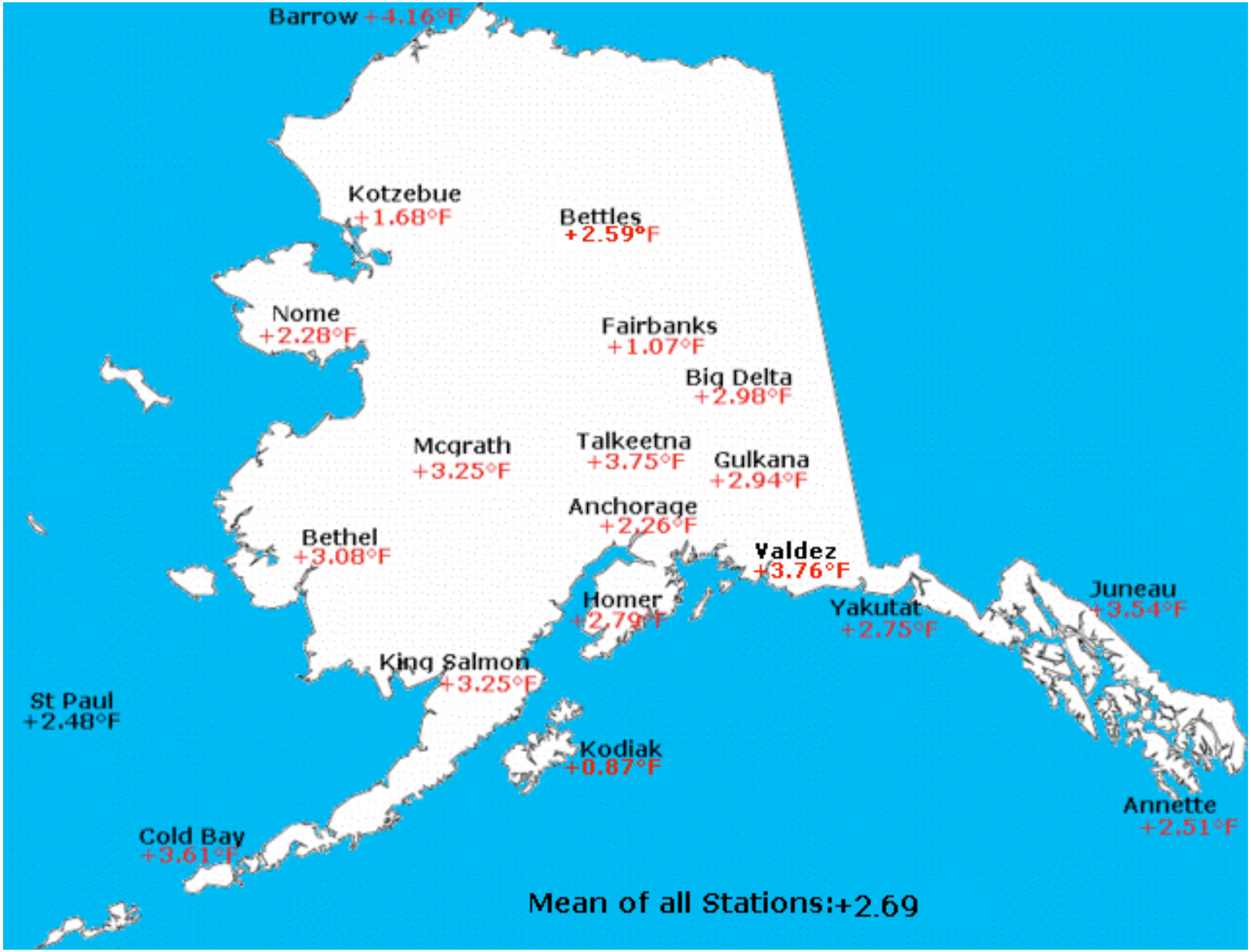

**Global to arctic**




**Polar amplification**


Fairbanks, Alaska Mean Minimum Daily temperature
1 May: 31 August
Degrees C
11
10
9
8
7
6
5
4
1905
1915
1925
1935
1945
1955
1965
1975
1985
1995
2005
Year

# Temperature change in Alaska, 1971-2000



Changes of Alaskan station temperatures (F), 1949-2003

## Seasonality of Alaskan Temperature Trends

| Station | Annual | Spring | Summer | Autumn | Winter |
|---|---|---|---|---|---|
| Arctic | | | | | |
| Barrow | +4.16 | +6.97 | +2.78 | +3.74 | +2.94 |
| Interior | | | | | |
| Bettles | +3.61 | +4.83 | -0.08 | -0.58 | +4.93 |
| Big Delta | +2.98 | +4.56 | +0.31 | -0.50 | +6.96 |
| Fairbanks | +1.07 | +3.55 | -0.05 | -2.50 | +3.05 |
| Mcgrath | +3.25 | +6.71 | +1.29 | -0.24 | +4.67 |
| West Coast | | | | | |
| Bethel | +3.08 | +7.64 | +1.44 | +0.21 | +3.03 |
| Cold Bay | +3.61 | +3.83 | +1.47 | +0.78 | +0.77 |
| King Salmon | +3.25 | +7.07 | +1.80 | +0.23 | +3.86 |
| Kotzebue | +1.68 | +3.56 | +0.16 | +0.24 | +2.64 |
| Nome | +2.28 | +6.27 | +0.39 | +0.03 | +2.16 |
| St. Paul | +2.48 | +4.73 | +3.07 | +1.07 | +1.62 |
| S. Central-S. East | | | | | |
| Anchorage | +2.26 | +3.99 | +1.47 | +0.60 | +3.17 |
| Annette | +2.51 | +3.34 | +1.88 | +1.08 | +3.39 |
| Gulkana | +2.94 | +5.53 | +0.62 | -3.42 | +5.9 |
| Homer | +2.79 | +4.63 | +2.50 | +0.92 | +3.42 |
| Kodiak | +0.87 | +2.67 | +1.65 | +0.56 | +0.15 |
| Juneau | +3.54 | +3.42 | +2.18 | +1.75 | +5.88 |
| Talkeetna | +3.75 | +5.74 | +1.97 | +2.46 | +6.01 |
| Valdez | +3.67 | +1.72 | +2.16 | -0.14 | +1.23 |
| Yakutat | +2.75 | +4.23 | +1.77 | +0.23 | +3.79 |
| **All Stations** | **+2.57** | **+4.23** | **+1.44** | **+0.33** | **+3.48** |
| **FANB** | **+2.44** | **+5.20** | **+1.15** | **+0.47** | **+2.83** |

Key:

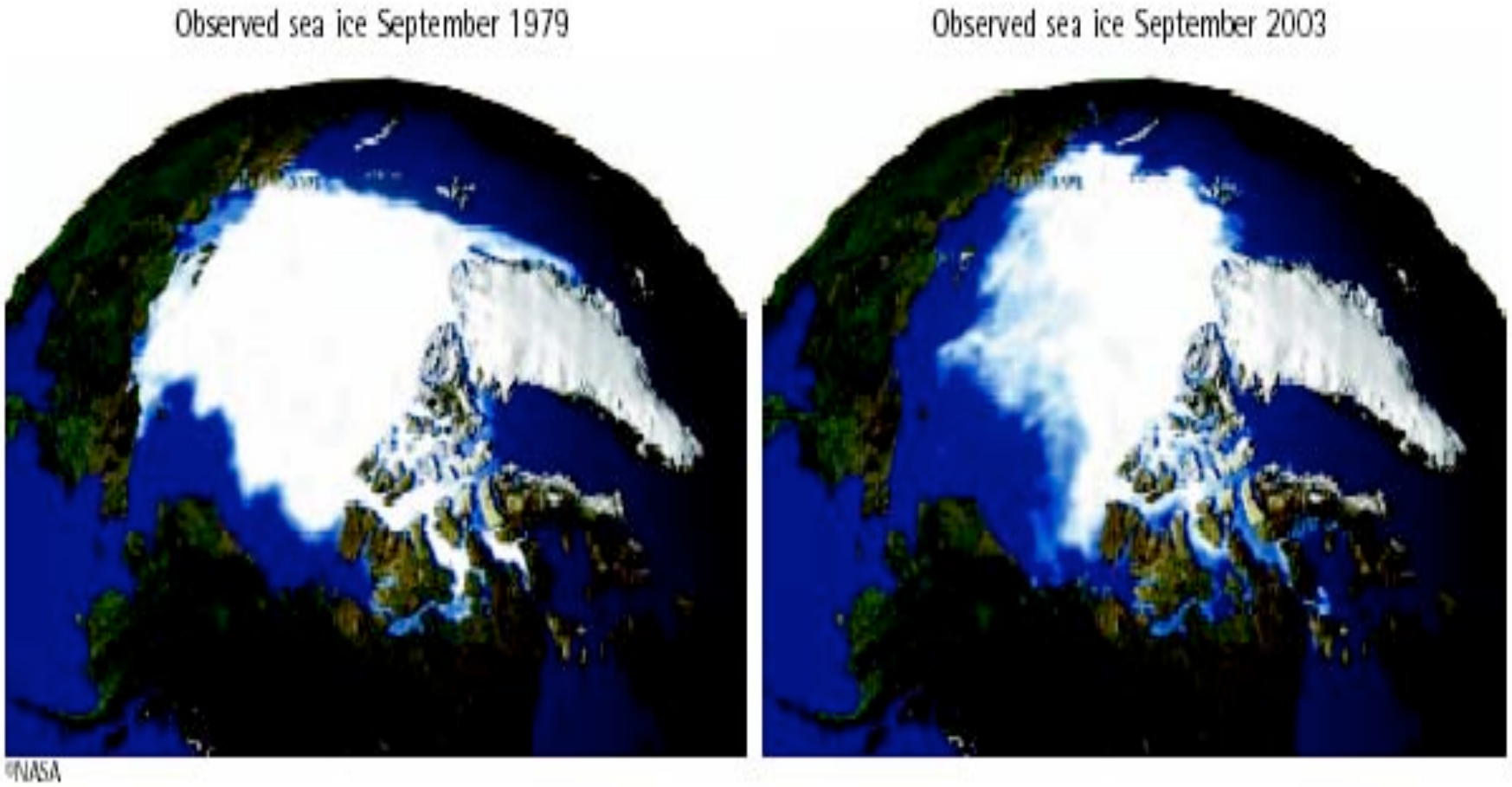
| -4 to -2 | -2 to 0 | 0 to +2 | +2 to +4 | +4 to +6 | +6 to +8 |
|---|---|---|---|---|---|

All Temperatures are in degrees Fahrenheit

# Why is warming fastest at high latitudes?

- Replacement of white (energy reflecting) with dark (energy absorbing) surfaces
  - Sea ice extent is shrinking
  - Snow is melting earlier
  - Glaciers are shrinking
- Vegetation is changing

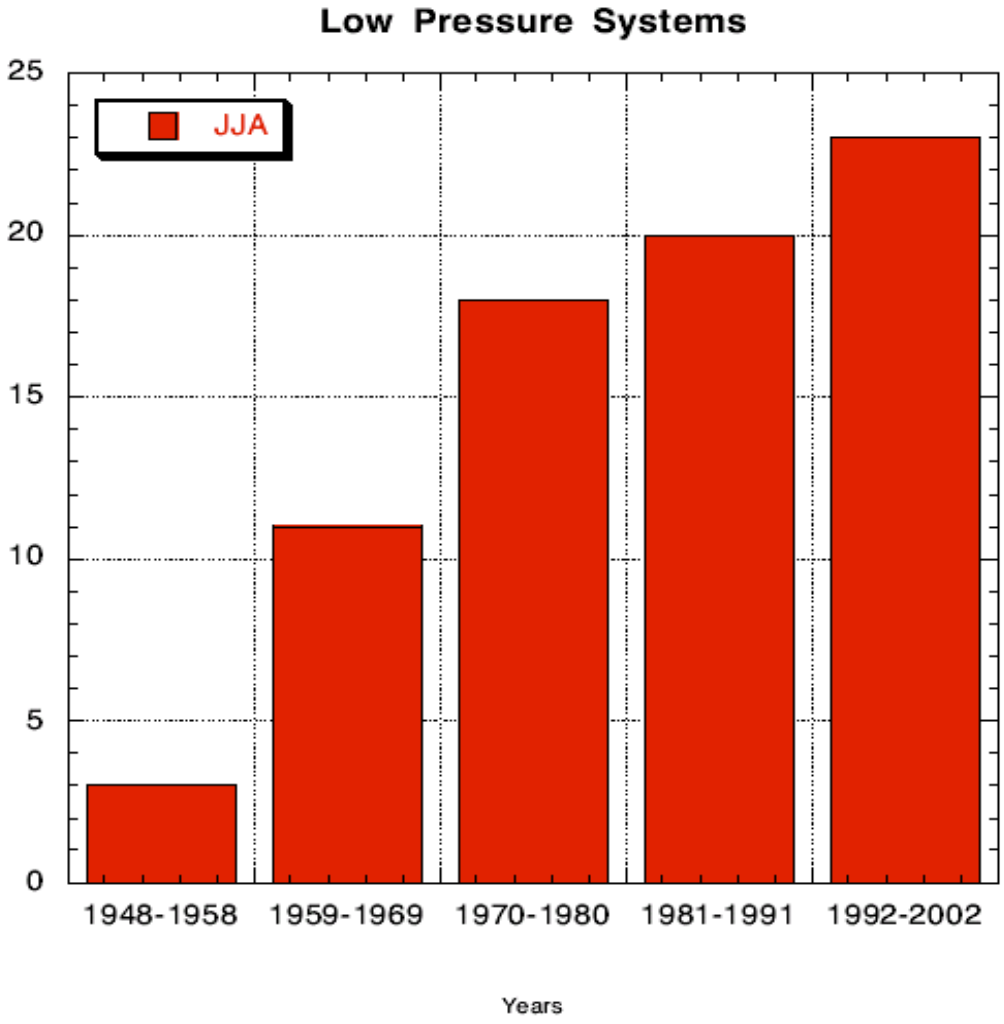
# Example of summer sea ice loss: 1979 to 2003



# Most important effects of warming are indirect

# IMPACTS OF A WARMING ARCTIC

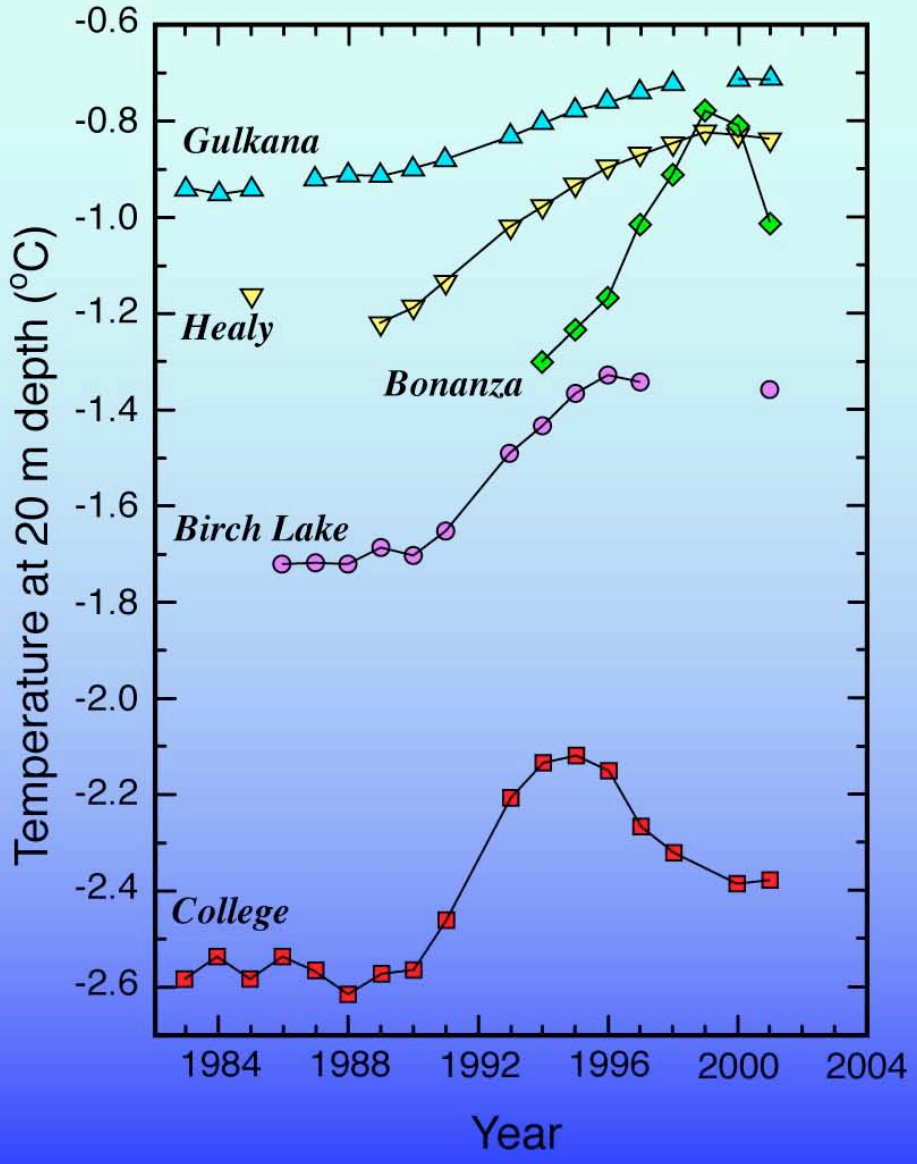
# Decadal distribution of most intense low-pressure centers over Arctic Ocean (June-August)



# Front Street, Nome

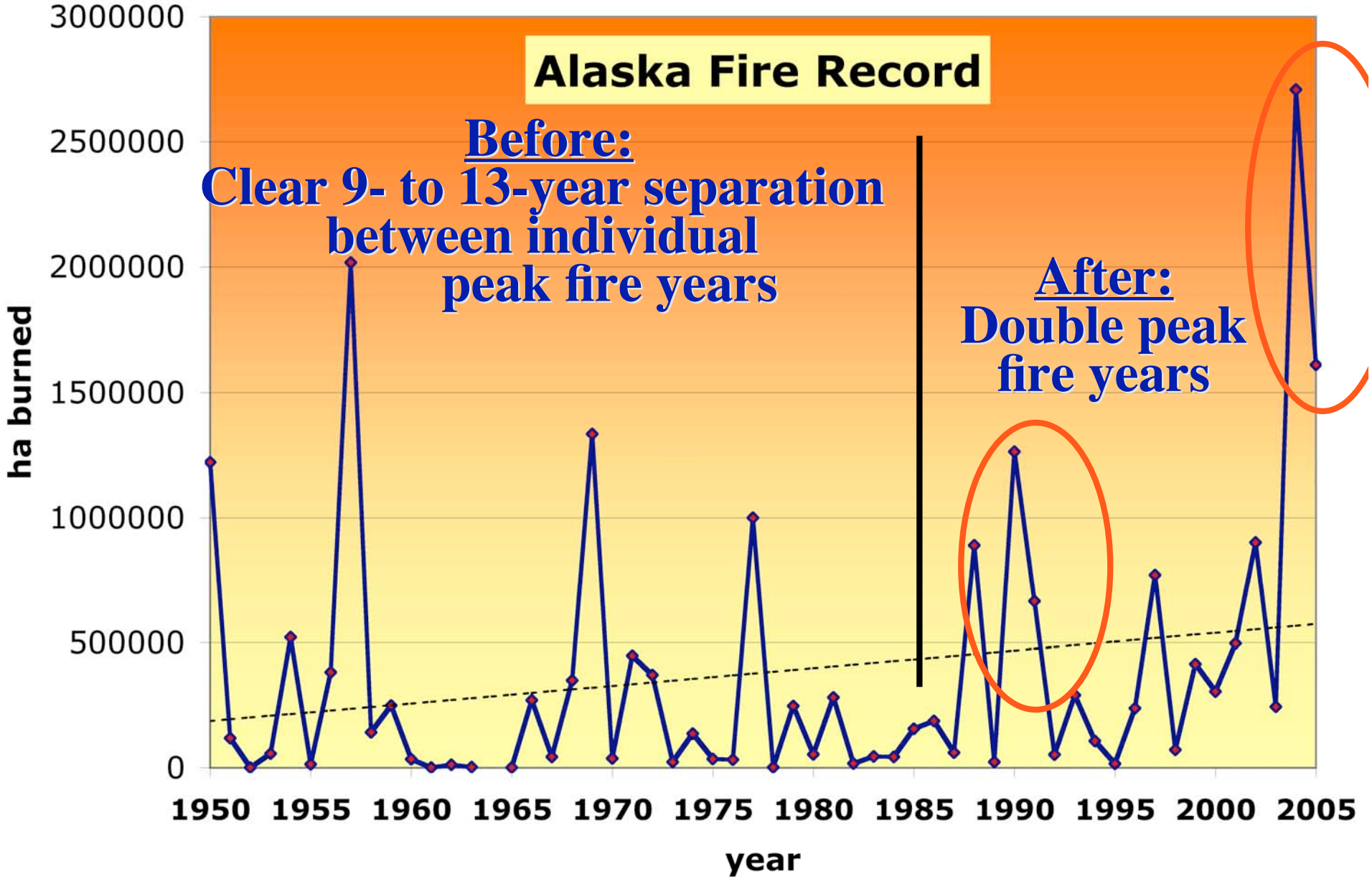
# Time series of permafrost temperatures at 20 m depth for sites south of the Yukon River in Alaska

(courtesy of Tom Osterkamp)



# Effects of thawing permafrost in discontinuous permafrost zone

(courtesy of Tom Osterkamp)


Alaska Fire Record
Before:
Clear 9- to 13-year separation between individual peak fire years
After:
Double peak fire years
ha burned
3000000
2500000
2000000
1500000
1000000
500000
0
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
year

# Will climate warming continue?

- Probably
- Depends on time frame of interest
  - In short term, climate variability is large
  - In long term, climate trends become important

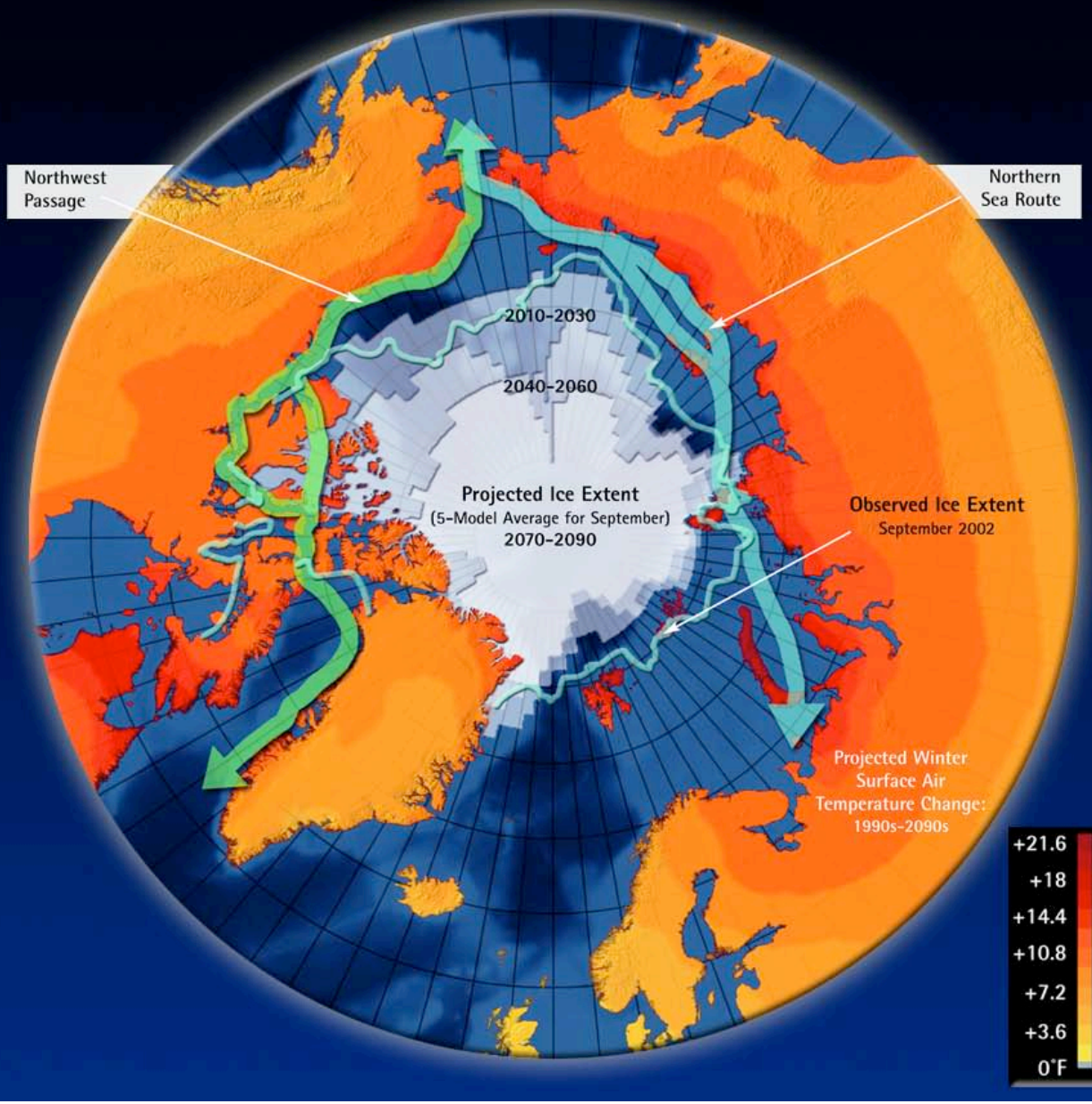
# Who should plan for climate change?

- **Next 5 years?** **No**
- **Next 10 years?** **Maybe**
- **Next 20-50 years?** **Yes**

# Challenges and Opportunities

- Challenges
  - Thawing permafrost
  - Thinner ice
  - More severe-fire years
- Opportunities
  - Northern sea routes
  - Longer growing season
  - Changes in winter tourism
  - Less severe living conditions

# IMPACTS OF A WARMING ARCTIC



# Links between science, business, and management

- Rapid climate change in Alaska is relevant to business and management
- Substantial scientific expertise in Alaska
  - Alaska is logical place to study climate change
- Scientists interested in making climate research relevant
- Seek your guidance in how to strengthen communication to provide more policy-relevant products